

REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the above amendment and in view of the following discussion is respectfully requested.

Claims 1-4 and 6-8 are pending in the present application. Claims 1, 4, 6, and 8 have been amended and Claim 5 has been canceled without prejudice by the present amendment.

In the outstanding Office Action, Claims 1, 2, 5, and 7 were rejected under 35 U.S.C. § 103(a) as unpatentable over Majumdar et al. (U.S. Patent No. 5,703,399, herein “Majumdar”) in view of Wensel (U.S. Patent No. 5,959,349); Claim 3 was rejected under 35 U.S.C. § 103(a) as unpatentable over Majumdar in view of Wensel and Tanaka et al. (U.S. Patent No. 5,293,301, herein “Tanaka”); and Claims 4, 6, and 8 were indicated as allowable if rewritten in independent form.

Applicant thanks the Examiner for the indication of allowable subject matter. In light of this indication, Claims 4 and 8 have been rewritten in independent form without adding new matter. Accordingly, Applicant believes that Claims 4 and 8 are in condition for allowance.

Further, it is respectfully requested this amendment be entered as it is believed that the present amendment places the claims in better form for consideration on appeal.

Applicant notes an Information Disclosure Statement was filed on October 1, 2004, which at this time has not been indicated as considered. Applicant respectfully requests the Examiner to consider and initial the references provided on the filed PTO-1449 form and to return the same to Applicant’s representative. A copy of the filed Information Disclosure Statement, the PTO-1449 form, and the date-stamped Filing Receipt are provided herewith for the Examiner’s convenience.

Regarding the rejection of Claims 1, 2, 5, and 7 under 35 U.S.C. § 103(a) as unpatentable over Majumdar in view of Wensel, Claim 1 has been amended to recite the features of Claim 5 and Claim 5 has been canceled. No new matter has been added.

Briefly recapitulating, amended Claim 1 is directed to a semiconductor device having a semiconductor element, a lead frame, a metal block, an insulation layer, a bonding material, and a resin package. The lead frame has a first surface on which the semiconductor element is mounted and a second surface opposite to the first surface. The metal block is on the second surface of the lead frame and the insulation layer is on the metal block opposite to the lead frame. The bonding material is between the second surface of the lead frame and the metal block and the bonding material has higher heat conduction than the insulation layer. The resin package seals the semiconductor element, the lead frame, and the metal block while uncovering the insulation layer. The insulation layer has a higher heat conduction than the resin package. In a non-limiting example, Figure 1 shows the semiconductor element 1, the lead frame 2a, the metal block 5, the insulation layer 7, the bonding material 10, and the resin package 6.

Turning to the applied art, Majumdar shows in Figure 13 a semiconductor element 4a, a lead frame 3, a heat sink 1, and a “highly heat conducting resin 2”¹ interposed between the lead frame 3 and the heat sink 1. The outstanding Office Action states at page 2, numbered paragraph 2, that Majumdar discloses “a bonding material 2 bonding between the second surface of the lead frame and the metal block” and “the bonding material 2 has a high heat conduction.”

Further, Majumdar discloses at column 8, lines 27-34, that “[t]he highly heat conducting resin 2 is composed of a kind of composite material composed of epoxy resin

¹ Majumdar, column 8, lines 9-21.

with fillers mixed therein, as of alumina or aluminum nitride.” Thus, the bonding material 2 of Majumdar includes both a resin and alumina or a similar material.

The outstanding Office Action relies on Wensel to teach “an insulation layer 228” on a metal block.² Wensel discloses that the insulation layer 228 is a dam that “may include any suitable metal ..., polyamides, and leadlock tape.”³ However, referring to Claim 5, the outstanding Office Action states at page 3, third paragraph, the “insulating layer [228] has a higher heat conduction than the resin package [224].” In order for the insulation layer 228 of Wensel to have the property asserted by the outstanding Office Action, the insulating layer 228 must include a metal because the resin package of Wensel is made of a resin. Thus, the insulation layer of Wensel has a structure similar to the structure of the highly heat conductive resin of Majumdar.

Accordingly, Applicant respectfully submits that because both the insulation layer 228 of Wensel and the highly heat conductive resin 2 of Majumdar have a similar chemical composition, the combination of Majumdar and Wensel cannot achieve a bonding material having a heat conduction higher than the insulation layer as required in amended Claim 1.

Based on the teachings of Majumdar and Wensel, one of ordinary skill in the art would obtain a semiconductor device having the bonding material and the insulation layer with identical heat conductions, contrary to the semiconductor device of Claim 1.

Therefore, Applicant respectfully submits that independent Claim 1 and each of the claims depending therefrom patentably distinguish over Majumdar and Wensel, either alone or in combination.

² Outstanding Office Action, page 3, line 1.

³ Wensel, column 5, lines 60-62.

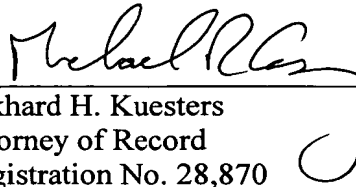
Regarding the rejection of Claim 3 under 35 U.S.C. § 103(a) as unpatentable over Majumdar in view of Wensel and Tanaka, Applicant respectfully traverses that rejection for the following reasons.

The outstanding Office Action relies on Tanaka for disclosing a semiconductor device including a metal block with a wider surface than a bonding material. However, Tanaka does not cure the deficiencies of Majumdar and Wensel discussed above. In addition, Claim 3 depends from independent Claim 1, which is believed to be allowable as noted above. Accordingly, it is respectfully submitted that dependent Claim 3 is also allowable.

Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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